

# **Gender Differences in X (Formerly Twitter) Use, Influence, and Engagement Among Cardiologists from Top U.S. News Best Hospitals**

Minji Seok, Sungjin Kim, Harper Tzou, Olivia Peony, Mitchell Kamrava, Andriana P Nikolova, Katelyn M Atkins

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# Gender Differences in X (Formerly Twitter) Use, Influence, and Engagement Among Cardiologists from Top U.S. News Best Hospitals

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## Abstract

Summary: This study highlights the rise of cardiology's presence on social media, specifically on the platform X (formerly Twitter) and explores the impact of social media on gender representation and existing gender gaps.

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## Original Manuscript

## Research Letter

# Gender Differences in X (Formerly Twitter) Use, Influence, and Engagement Among Cardiologists from Top U.S. News Best Hospitals

Keywords: Social Media; Women in Medicine; Health Communication; Technology

## Introduction

Women in medicine face significant barriers to compensation, career advancement, and research support even when controlling for specialty, age, and/or clinical experience [1]. These effects are especially pronounced in cardiology, where women comprise only 15% of practicing cardiologists and are less likely to be leaders of clinical trials or present late breaking trials at major cardiovascular conferences [2-4]. Social media platforms, such as X (formerly Twitter), can foster collaboration, mentorship, and promotion of research [5,6]. However, studies examining the impact of X on existing gender gaps are limited. In this study, we aimed to analyze differences in X-users vs non-X users and differences in X use by gender among adult cardiologists.

## Methods

This cross-sectional study was exempt from ethical approval due to use of publicly available data. The top 20 U.S. News Best Hospitals for cardiology, heart & vascular surgery were identified from the 2023 ranking (**Table 1**) [7]. Available physician website profiles of fellowship trained adult medicine cardiologists were manually reviewed by three investigators (MS, HT, OP) for inclusion and demographic information collected (e.g., academic appointment, apparent gender, medical school and fellowship graduation years). Physicians were evaluated for the presence of an 'X' account, and public data manually collected between December 8, 2023, and May 9, 2024. Differences in non-X (vs X) users, as well as women vs men X-users were compared using Wilcoxon rank-sum test for continuous variables and chi-square or Fisher's exact test for categorical

variables as appropriate.

**Table 1.** Top 20 U.S. News best hospitals for cardiology, heart & vascular surgery (2023 ranking)

| Institution name                                      | State          | Physicians<br>(total;<br>n=2022), n (%) | Physicians on<br>X (n=753), n<br>(%) |
|-------------------------------------------------------|----------------|-----------------------------------------|--------------------------------------|
| Brigham and Womens                                    | MA             | 143 (7.07)                              | 73 (9.69)                            |
| Cedars Sinai                                          | CA             | 56 (2.77)                               | 22 (2.92)                            |
| Cleveland Clinic                                      | FL and OH      | 126 (6.23)                              | 51 (6.77)                            |
| Johns Hopkins                                         | MD             | 102 (5.04)                              | 35 (4.65)                            |
| Houston Methodist                                     | TX             | 64 (3.17)                               | 33 (4.38)                            |
| Lenox Hill at Northwell                               | NY             | 117 (5.79)                              | 27 (3.59)                            |
| Massachusetts General                                 | MA             | 100 (4.95)                              | 57 (7.57)                            |
| Mayo Clinic Rochester                                 | MN             | 156 (7.72)                              | 68 (9.03)                            |
| Mount Sinai                                           | FL, NJ, and NY | 201 (9.94)                              | 64 (8.5)                             |
| NewYork-Presbyterian Hospital Columbia<br>and Cornell | NY             | 54 (2.67)                               | 15 (1.99)                            |
| NYU Langone Hospitals                                 | NY             | 164 (8.11)                              | 20 (2.66)                            |
| Northwell Northshore                                  | NY             | 93 (4.6)                                | 15 (1.99)                            |
| Northwestern                                          | IL             | 112 (5.54)                              | 47 (6.24)                            |
| Rush University                                       | IL             | 44 (2.18)                               | 22 (2.92)                            |
| Stanford Hospital                                     | CA             | 88 (4.35)                               | 45 (5.98)                            |
| Texas Heart Institute at Baylor                       | TX             | 14 (0.69)                               | 5 (0.66)                             |
| University of California, Los Angeles                 | CA             | 76 (3.76)                               | 29 (3.85)                            |
| UT Southwestern                                       | TX             | 77 (3.81)                               | 38 (5.05)                            |
| University of Pennsylvania                            | PA             | 134 (6.63)                              | 58 (7.7)                             |
| Vanderbilt                                            | TN             | 101 (5)                                 | 29 (3.85)                            |

## Results

A total of 2,022 cardiology physician profiles were analyzed, of which 37% (n=753) were on X and 63% not on X (n=1269). Compared to non-users, X-users had an increased proportion of women (32% vs 21%,  $P < .001$ ), held higher academic faculty appointments, and additional advanced degrees (all  $P < .001$ ). Women X-users (vs men) had similar years in practice, defined as fellowship training completion to the year 2024 (median 10 vs 12 years,  $P = .14$ ) but had significantly fewer years since joining X (median 6.4 vs 7.8 years,  $P < .001$ ). Adjusting for number of years on X, women (vs men) showed similar levels of influence (median 71 vs 78 followers/X-years,  $P = .68$ ), and posts (median 29 vs 28/X-years,  $P = .98$ ), but higher levels of self-engagement in the form of following more users (median 32 vs 42/X-years,  $P = .02$ ) and liking more posts (median 65 vs

113/X-years,  $P = .02$ ) (Table 2). On a thematic analysis of biographical text, women (vs men) were more likely to mention being a parent (21% vs 13%,  $P=.006$ ), but there was no difference in mentions of job or hobbies ( $P=.36, .89$ ) (Table 2).

**Table 2** Characteristics and demographics of top hospital cardiologists on X, stratified by gender

| Variable                               | Not on X<br>(n=1269) | On X<br>(n=753) | P-<br>value <sup>a</sup> | Male on X<br>(n=513) | Female on X<br>(n=240) | P-value <sup>b</sup> |
|----------------------------------------|----------------------|-----------------|--------------------------|----------------------|------------------------|----------------------|
| Geographic region                      |                      |                 |                          |                      |                        |                      |
| Northeast                              | 741 (58.39)          | 364 (48.34)     | <.001                    | 245 (47.76)          | 119 (49.58)            | .72                  |
| Midwest                                | 249 (19.62)          | 187 (24.83)     |                          | 130 (25.34)          | 57 (23.75)             |                      |
| South                                  | 155 (12.21)          | 106 (14.08)     |                          | 69 (13.45)           | 37 (15.42)             |                      |
| West                                   | 124 (9.77)           | 96 (12.75)      |                          | 69 (13.45)           | 27 (11.25)             |                      |
| Gender                                 |                      |                 |                          |                      |                        |                      |
| Male                                   | 1000 (78.8)          | 513 (68.13)     | <.001                    |                      |                        |                      |
| Female                                 | 269 (21.2)           | 240 (31.87)     |                          |                      |                        |                      |
| Faculty type                           |                      |                 |                          |                      |                        |                      |
| Not explicitly Listed                  | 347 (27.34)          | 191 (25.37)     | <.001                    | 135 (26.32)          | 56 (23.33)             | .06                  |
| Instructor/Clinician                   | 97 (7.64)            | 39 (5.18)       |                          | 21 (4.09)            | 18 (7.5)               |                      |
| Assistant                              | 441 (34.75)          | 227 (30.15)     |                          | 149 (29.04)          | 78 (32.5)              |                      |
| Associate                              | 208 (16.39)          | 153 (20.32)     |                          | 100 (19.49)          | 53 (22.08)             |                      |
| Professor                              | 176 (13.87)          | 143 (18.99)     |                          | 108 (21.05)          | 35 (14.58)             |                      |
| No. leadership titles                  |                      |                 |                          |                      |                        |                      |
| 0                                      | 840 (66.19)          | 360 (47.81)     | <.001                    | 239 (46.59)          | 121 (50.42)            | .11                  |
| 1                                      | 306 (24.11)          | 241 (32.01)     |                          | 159 (30.99)          | 82 (34.17)             |                      |
| 2                                      | 95 (7.49)            | 111 (14.74)     |                          | 85 (16.57)           | 26 (10.83)             |                      |
| 3+                                     | 28 (2.21)            | 41 (5.44)       |                          | 30 (5.85)            | 11 (4.58)              |                      |
| Subspecialty                           |                      |                 |                          |                      |                        |                      |
| General                                | 552 (43.53)          | 213 (28.29)     | <.001                    | 133 (25.93)          | 80 (33.33)             | <.001                |
| Interventional                         | 226 (17.82)          | 112 (14.87)     |                          | 90 (17.54)           | 22 (9.17)              |                      |
| Imaging                                | 193 (15.22)          | 121 (16.07)     |                          | 68 (13.26)           | 53 (22.08)             |                      |
| Congenital                             | 31 (2.44)            | 24 (3.19)       |                          | 12 (2.34)            | 12 (5)                 |                      |
| HF                                     | 91 (7.18)            | 121 (16.07)     |                          | 78 (15.2)            | 43 (17.92)             |                      |
| EP                                     | 138 (10.88)          | 95 (12.62)      |                          | 84 (16.37)           | 11 (4.58)              |                      |
| Other                                  | 37 (2.92)            | 67 (8.9)        |                          | 48 (9.36)            | 19 (7.92)              |                      |
| Dual Degree                            |                      |                 |                          |                      |                        |                      |
| PhD                                    |                      |                 |                          |                      |                        |                      |
| No                                     | 1183 (93.22)         | 662 (87.92)     | <.001                    | 447 (87.13)          | 215 (89.58)            | .34                  |
| Yes                                    | 86 (6.78)            | 91 (12.08)      |                          | 66 (12.87)           | 25 (10.42)             |                      |
| MS                                     |                      |                 |                          |                      |                        |                      |
| No                                     | 1220 (96.14)         | 679 (90.17)     | <.001                    | 464 (90.45)          | 215 (89.58)            | .71                  |
| Yes                                    | 49 (3.86)            | 74 (9.83)       |                          | 49 (9.55)            | 25 (10.42)             |                      |
| MPH                                    |                      |                 |                          |                      |                        |                      |
| No                                     | 1226 (96.61)         | 680 (90.31)     | <.001                    | 461 (89.86)          | 219 (91.25)            | .55                  |
| Yes                                    | 43 (3.39)            | 73 (9.69)       |                          | 52 (10.14)           | 21 (8.75)              |                      |
| MBA                                    |                      |                 |                          |                      |                        |                      |
| No                                     | 1255 (98.9)          | 740 (98.27)     | .24                      | 503 (98.05)          | 237 (98.75)            | .76                  |
| Yes                                    | 14 (1.1)             | 13 (1.73)       |                          | 10 (1.95)            | 3 (1.25)               |                      |
| Practice duration (years) <sup>c</sup> |                      |                 |                          |                      |                        |                      |
| Median (IQR)                           | 21 (12 - 31)         | 11 (6 - 21)     | <.001                    | 12 (1 - 48)          | 10 (1 - 45)            | .14                  |
| < 9                                    | 152 (37.91)          | 249 (62.09)     |                          | 117 (68.82)          | 53 (31.18)             |                      |

| Variable                                                                                                                                                                                  | Not on X<br>(n=1269) | On X<br>(n=753) | P-<br>value <sup>a</sup> | Male on X<br>(n=513)   | Female on X<br>(n=240) | P-value <sup>b</sup> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-----------------|--------------------------|------------------------|------------------------|----------------------|
| [9, 17)                                                                                                                                                                                   | 270 (60.81)          | 174 (39.19)     |                          | 153 (63.22)            | 89 (36.78)             | [7, 11)              |
| [17, 28)                                                                                                                                                                                  | 292 (67.13)          | 143 (32.87)     |                          | 123 (69.49)            | 54 (30.51)             | [11, 21)             |
| ≥ 28                                                                                                                                                                                      | 359 (80.86)          | 85 (19.14)      |                          | 120 (73.17)            | 44 (26.83)             | ≥ 21                 |
| X Use Variables (Publicly Available)                                                                                                                                                      |                      |                 |                          |                        |                        |                      |
| Time on X (years)                                                                                                                                                                         |                      |                 |                          |                        |                        |                      |
| Median (IQR)                                                                                                                                                                              |                      |                 |                          | 7.8 (5.3 - 11.34)      | 6.39 (5.06 - 10.11)    | <.001                |
| Average number of followers per year on X                                                                                                                                                 |                      |                 |                          |                        |                        |                      |
| Median (IQR)                                                                                                                                                                              |                      |                 |                          | 78.05 (24.96 - 197.33) | 71.46 (24.8 - 180.84)  | .68                  |
| Average number of following per year on X                                                                                                                                                 |                      |                 |                          |                        |                        |                      |
| Median (IQR)                                                                                                                                                                              |                      |                 |                          | 31.9 (11.48 - 70.4)    | 42.11 (16.8 - 84.77)   | .02                  |
| Average number of tweets per year on X                                                                                                                                                    |                      |                 |                          |                        |                        |                      |
| Median (IQR)                                                                                                                                                                              |                      |                 |                          | 28.04 (5.22 - 111.15)  | 29.1 (5.06 - 102.47)   | .98                  |
| Average number of media posts per year on X                                                                                                                                               |                      |                 |                          |                        |                        |                      |
| Median (IQR)                                                                                                                                                                              |                      |                 |                          | 2.27 (0.26 - 10.38)    | 2.2 (0.26 - 10.78)     | .96                  |
| Average number of liked posts per year on X                                                                                                                                               |                      |                 |                          |                        |                        |                      |
| Median (IQR)                                                                                                                                                                              |                      |                 |                          | 64.49 (6.94 - 318.98)  | 112.52 (16.58 - 430.1) | .02                  |
| Thematic Content of X Biography                                                                                                                                                           |                      |                 |                          |                        |                        |                      |
| Job Roles                                                                                                                                                                                 |                      |                 |                          |                        |                        |                      |
| No mention                                                                                                                                                                                |                      |                 |                          | 98 (19.1)              | 39 (16.32)             | .36                  |
| Mention                                                                                                                                                                                   |                      |                 |                          | 415 (80.9)             | 200 (83.68)            |                      |
| Specialty                                                                                                                                                                                 |                      |                 |                          |                        |                        |                      |
| No mention                                                                                                                                                                                |                      |                 |                          | 169 (32.94)            | 85 (35.56)             | .48                  |
| Mention                                                                                                                                                                                   |                      |                 |                          | 344 (67.06)            | 154 (64.44)            |                      |
| Parent                                                                                                                                                                                    |                      |                 |                          |                        |                        |                      |
| No mention                                                                                                                                                                                |                      |                 |                          | 449 (87.52)            | 191 (79.92)            | .006                 |
| Mention                                                                                                                                                                                   |                      |                 |                          | 64 (12.48)             | 48 (20.08)             |                      |
| Spouse                                                                                                                                                                                    |                      |                 |                          |                        |                        |                      |
| No mention                                                                                                                                                                                |                      |                 |                          | 467 (91.03)            | 216 (90.38)            | .77                  |
| Mention                                                                                                                                                                                   |                      |                 |                          | 46 (8.97)              | 23 (9.62)              |                      |
| Institution                                                                                                                                                                               |                      |                 |                          |                        |                        |                      |
| No mention                                                                                                                                                                                |                      |                 |                          | 148 (28.85)            | 64 (26.78)             | .56                  |
| Mention                                                                                                                                                                                   |                      |                 |                          | 365 (71.15)            | 175 (73.22)            |                      |
| Personal Interests                                                                                                                                                                        |                      |                 |                          |                        |                        |                      |
| No mention                                                                                                                                                                                |                      |                 |                          | 444 (86.55)            | 206 (86.19)            | .89                  |
| Mention                                                                                                                                                                                   |                      |                 |                          | 69 (13.45)             | 33 (13.81)             |                      |
| Data are presented as number of subjects (column %) or median (IQR, interquartile range).                                                                                                 |                      |                 |                          |                        |                        |                      |
| <sup>a</sup> Compare not on X with X.                                                                                                                                                     |                      |                 |                          |                        |                        |                      |
| <sup>b</sup> Compare male on X with female on X.                                                                                                                                          |                      |                 |                          |                        |                        |                      |
| <sup>a,b</sup> P-value is calculated by Wilcoxon rank-sum test for continuous and ordinal variables; and chi-square test or Fisher's exact test for categorical variables as appropriate. |                      |                 |                          |                        |                        |                      |
| <sup>c</sup> Number of subjects (row %)                                                                                                                                                   |                      |                 |                          |                        |                        |                      |

## Discussion

In our analysis of U.S. News top hospital cardiologists, the proportion of women on X was higher than non-X-users. One possible explanation for this observation is that women cardiologists may be seeking novel opportunities for networking, collaboration, visibility, and/or self-promotion

not available through traditional channels [5]. In addition, we observed that while women cardiologists had similar time-adjusted follower counts, they “liked” more posts. This finding is consistent with content language analyses demonstrating higher expected levels of “friendliness” in women’s professional communications, including more frequent use of exclamation points as markers of “friendly interaction”, which is associated with increased emotional labor [8,9] We also observed that women cardiologists were more likely to mention being a parent, suggesting that women may be more comfortable highlighting work-life integration factors. This is not surprising, as women physicians have been observed to join social media groups discussing issues such as parenting, maternity leave, and leadership of women in medicine[5]. Together, these observations support efforts to better understand motivational differences in social media use and the impact on potential downstream professional benefits.

Our study has several limitations, namely that institutional websites are subject to inaccuracy and incompleteness, currently available X data are more limited compared to prior studies, limited physician practice type information, and potential mis-gendering [10]. Despite these limitations, our findings highlight the increased presence of women cardiologists on X, with similar influence and higher engagement despite short time on X. These findings are suggestive of an inherent desire to engage on social media for professional use, though the motivating factors driving these behavioral differences and its impact on existing gender disparities is worthy of further study.

## Data Availability

The datasets generated or analyzed during this study are available from the corresponding author on reasonable request.

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Data curation – MS, SK, HT, OP  
Formal analysis – MS, SK  
Funding acquisition – N/A  
Investigation - MS, SK, HT, OP  
Methodology – KA, SK, MS, MK  
Project administration – KA, AN  
Resources – KA, SK  
Software – SK  
Supervision – KA, AN  
Validation – KA, SK  
Visualization – KA, AN, MK, SK, MS  
Writing – original draft – KA, MS  
Writing – review & editing – KA, AN, MS, MK

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## Conflicts of Interest

KA reports honoraria from OncLive, outside of the submitted work. The remaining authors have no disclosures.

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